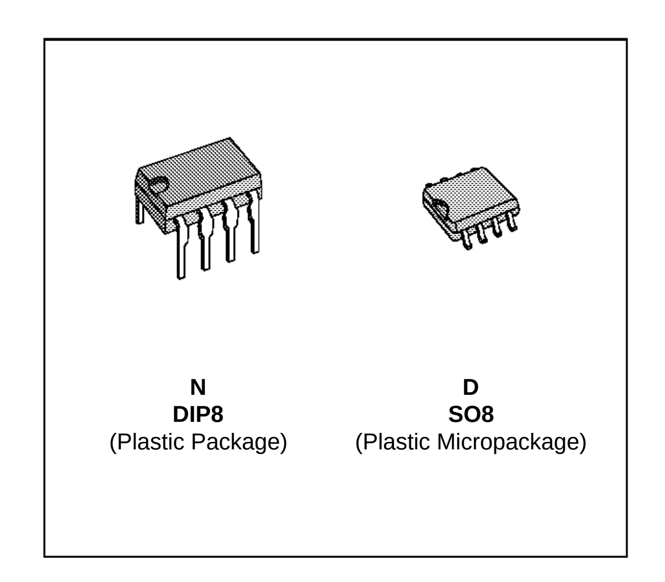


TL061
TL061A - TL061B

LOW POWER SINGLE J-FET OPERATIONAL AMPLIFIERS

- VERY LOW POWER CONSUMPTION :
- WIDE COMMON-MODE (UP TO V_{CC}^+) AND DIFFERENTIAL VOLTAGE RANGES
- LOW INPUT BIAS AND OFFSET CURRENTS
- TYPICAL SUPPLY CURRENT : 200µA
- OUTPUT SHORT-CIRCUIT PROTECTION
- HIGH INPUT IMPEDANCE J-FET INPUT STAGE
- INTERNAL FREQUENCY COMPENSATION
- LATCH UP FREE OPERATION
- HIGH SLEW RATE : 3.5V/µs (TYP)



DESCRIPTION

The TL061, TL061A and TL061B are high speed J-FET input single operational amplifier family. Each of these J-FET input operational amplifiers incorporates well matched, high voltage J-FET and bipolar transistors in a monolithic integrated circuit.

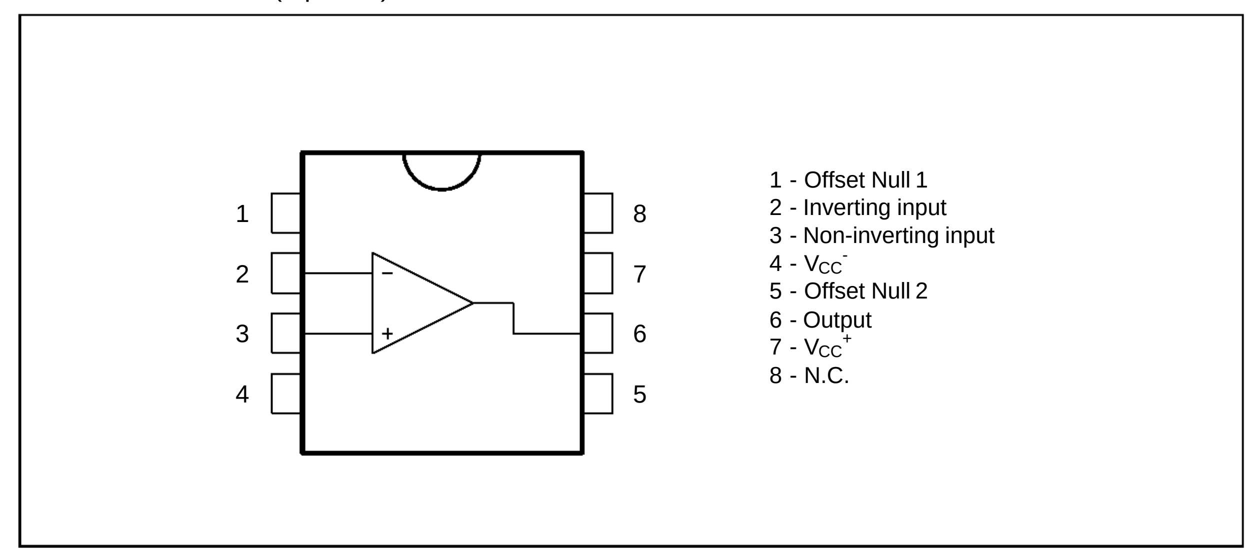
The devices feature high slew rates, low input bias and offset currents, and low offset voltage temperature coefficient.

ORDER CODES

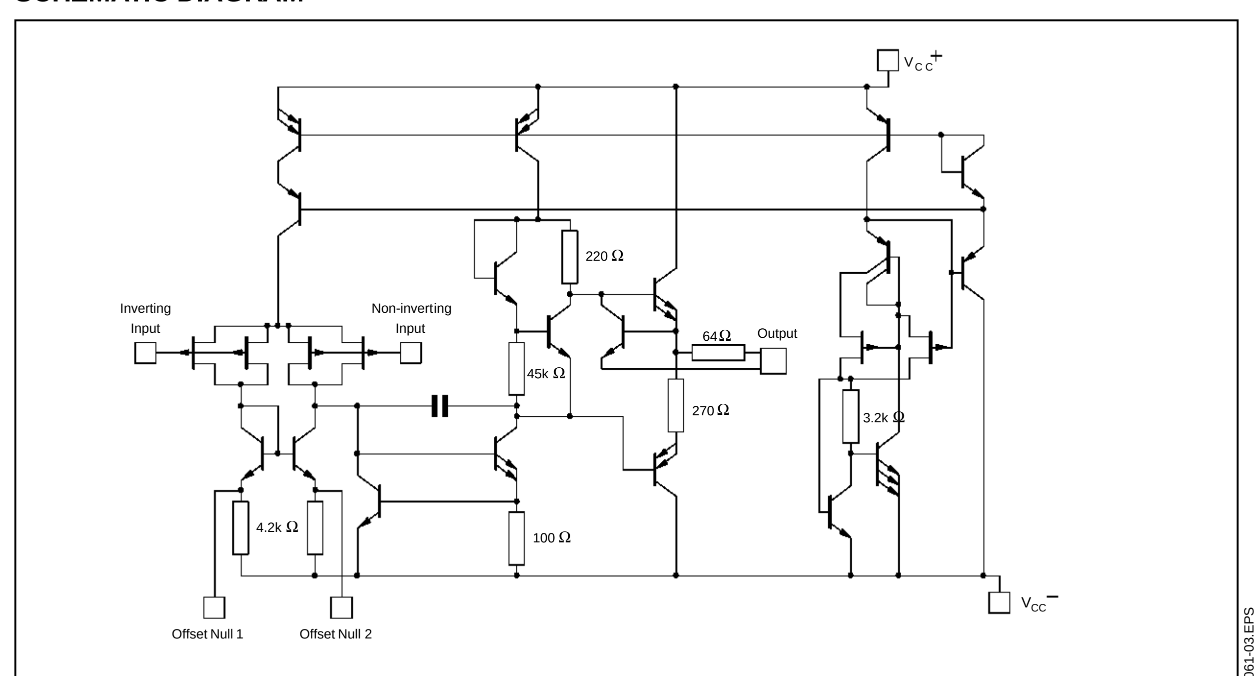
Part Number	Temperature Range	Package	
		N	D
TL061M/AM/BM	-55°C, +125°C	•	l
TL061I/AI/BI	-40°C, +105°C	•	l
TL061C/AC/BC	0°C, +70°C	•	•
Example : TL061IN			

061-01.TBL

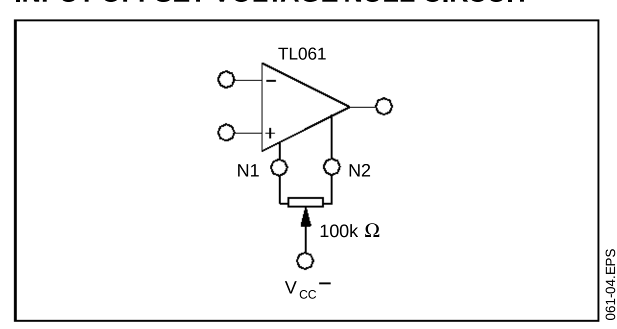
PIN CONNECTIONS (top view)



SCHEMATIC DIAGRAM



INPUT OFFSET VOLTAGE NULL CIRCUIT



MAXIMUM RATINGS

Symbol	Parameter	TL061M,AM,BM	TL061I,AI,BI	TL061C,AC,BC	Unit
V_{CC}	Supply Voltage - (note 1)	±18	±18	±18	V
V_i	Input Voltage - (note 3)	±15	±15	±15	V
V_{id}	Differential Input Voltage - (note 2)	±30	±30	±30	V
P_{tot}	Power Dissipation	680	680	680	mW
	Output Short-Circuit Duration (Note 4)	Infinite	Infinite	Infinite	
T_{oper}	Operating Free-Air Temperature Range	-55 to +125	-40 to +105	0 to +70	^oC
T_{stg}	Storage Temperature Range	- 65 to + 150	- 65 to + 150	- 65 to + 150	^oC

061-02.TBL

Notes :
1. All voltage values, except differential voltage, are with respect to the zero reference level (ground) of the supply voltages where the zero reference level is the midpoint between V_{CC}^+ and V_{CC}^-.
2. Differential voltages are the non-inverting input terminal with respect to the inverting input terminal.
3. The magnitude of the input voltage must never exceed the magnitude of the supply voltage or 15 volts, whichever is less.
4. The output may be shorted to ground or to either supply. Temperature and/or supply voltages must be limited to ensure that the dissipation rating is not exceeded.

ELECTRICAL CHARACTERISTICS

$V_{CC} = \pm 15V$, $T_{amb} = 25^oC$ (unless otherwise specified)

Symbol	Parameter	TL061M			TL061I			TL061C			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{io}	Input Offset Voltage ($R_s = 50\Omega$) $T_{amb} = 25^oC$ $T_{min.} \leq T_{amb} \leq T_{max.}$		 3	 6 9		 3	 6 9		 3	 15 20	mV
DV_{io}	Temperature Coefficient of Input Offset Voltage ($R_s = 50\Omega$)		10			10			10		$\mu V/^oC$
I_{io}	Input Offset Current * $T_{amb} = 25^oC$ $T_{min.} \leq T_{amb} \leq T_{max.}$		 5	 100 20		 5	 100 10		 5	 200 5	 pA nA
I_{ib}	Input Bias Current * $T_{amb} = 25^oC$ $T_{min.} \leq T_{amb} \leq T_{max.}$		 30	 200 50		 30	 200 20		 30	 400 10	 pA nA
V_{icm}	Input Common Mode Voltage Range	±11.5	+15 -12		±11.5	+15 -12		±11	+15 -12		V
V_{OPP}	Output Voltage Swing ($R_L = 10k\Omega$) $T_{amb} = 25^oC$ $T_{min.} \leq T_{amb} \leq T_{max.}$	 20 20	 27		 20 20	 27		 20 20	 27		V
A_{vd}	Large Signal Voltage Gain ($R_L = 10k\Omega$, $V_o = \pm 10V$) $T_{amb} = 25^oC$ $T_{min.} \leq T_{amb} \leq T_{max.}$	 4 4	 6		 4 4	 6		 3 3	 6		V/mV
GBP	Gain Bandwidth Product ($T_{amb} = 25^oC$, $R_L = 10k\Omega$ $C_L = 100pF$)		1			1			1		MHz
R_i	Input Resistance		10^{12}			10^{12}			10^{12}		Ω
CMR	Common Mode Rejection Ratio ($R_s = 50\Omega$)	80	86		80	86		70	76		dB
SVR	Supply Voltage Rejection Ratio ($R_s = 50\Omega$)	80	95		80	95		70	95		dB
I_{cc}	Supply Current ($T_{amb} = 25^oC$, no load, no signal)		200	250		200	250		200	250	μA
P_D	Total Power Consumption ($T_{amb} = 25^oC$, no load, no signal)		6	7.5		6	7.5		6	7.5	mW

061-03.TBL

* The input bias currents of a FET-input operational amplifier are normal junction reverse currents, which are temperature sensitive. Pulse techniques must be used that will maintain the junction temperature as close to the ambient temperature as possible.

ELECTRICAL CHARACTERISTICS (continued)

$V_{CC} = \pm 15V$, $T_{amb} = 25^oC$

Symbol	Parameter	TL061C,I,M			Unit
		Min.	Typ.	Max.	
SR	Slew Rate ($V_i = 10V$, $R_L = 10k\Omega$, $C_L = 100pF$, $A_V = 1$)	1.5	3.5		$V/\mu s$
t_r	Rise Time ($V_i = 20mV$, $R_L = 10k\Omega$, $C_L = 100pF$, $A_V = 1$)		0.2		μs
K_{OV}	Overshoot Factor ($V_i = 20mV$, $R_L = 10k\Omega$, $C_L = 100pF$, $A_V = 1$) (see figure 1)		10		%
e_n	Equivalent Input Noise Voltage ($R_s = 100\Omega$, $f = 1KHz$)		42		$\frac{nV}{\sqrt{Hz}}$

061-04.TBL

ELECTRICAL CHARACTERISTICS (continued)
$V_{CC} = \pm$ 15V, $T_{amb} = 25^oC$ (unless otherwise specified)

Symbol	Parameter	TL061AC,AI,AM			TL061BC,BI,BM			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{io}	Input Offset Voltage ($R_s = 50\Omega$) $T_{amb} = 25^oC$ $T_{min.} \leq T_{amb} \leq T_{max.}$		3	6 7.5		2	3 5	mV
DV_{io}	Temperature Coefficient of Input Offset Voltage ($R_s = 50\Omega$)		10			10		$\mu V/^oC$
I_{io}	Input Offset Current * $T_{amb} = 25^oC$ $T_{min.} \leq T_{amb} \leq T_{max.}$		5	100 3		5	100 3	pA nA
I_{ib}	Input Bias Current * $T_{amb} = 25^oC$ $T_{min.} \leq T_{amb} \leq T_{max.}$		30	200 7		30	200 7	pA nA
V_{icm}	Input Common Mode Voltage Range	±11.5	+15 -12		±11.5	+15 -12		V
V_{OPP}	Output Voltage Swing ($R_L = 10k\Omega$) $T_{amb} = 25^oC$ $T_{min.} \leq T_{amb} \leq T_{max.}$	20 20	27		20 20	27		V
A_{vd}	Large Signal Voltage Gain ($R_L = 10k\Omega$, $V_o = \pm$ 10V) $T_{amb} = 25^oC$ $T_{min.} \leq T_{amb} \leq T_{max.}$	4 4	6		4 4	6		V/mV
GBP	Gain Bandwidth Product ($T_{amb} = 25^oC$, $R_L = 10k\Omega$, C_L = 100pF)		1			1		MHz
R_i	Input Resistance		10^{12}			10^{12}		Ω
CMR	Common Mode Rejection Ratio ($R_s = 50\Omega$, $T_{amb} = 25^oC$)	80	86		80	86		dB
SVR	Supply Voltage Rejection Ratio ($R_s = 50\Omega$, $T_{amb} = 25^oC$)	80	95		80	95		dB
I_{cc}	Supply Current, no Load ($T_{amb} = 25^oC$, no load, no signal)		200	250		200	250	μA
P_D	Total Power Consumption ($T_{amb} = 25^oC$, no load, no signal)		6	7.5		6	7.5	mW
SR	Slew Rate (V_i = 10V, $R_L = 10k\Omega$, C_L = 100pF, A_V = 1)	1.5	3.5		1.5	3.5		$V/\mu s$
t_r	Rise Time (V_i = 20mV, $R_L = 10k\Omega$, C_L = 100pF, A_V = 1)		0.2			0.2		μs
K_{OV}	Overshoot Factor (V_i = 20mV, $R_L = 10k\Omega$, C_L = 100pF, A_V = 1) - (see figure 1)		10			10		%
e_n	Equivalent Input Noise Voltage ($R_s = 100\Omega$, f = 1KHz)		42			42		$\frac{nV}{\sqrt{Hz}}$

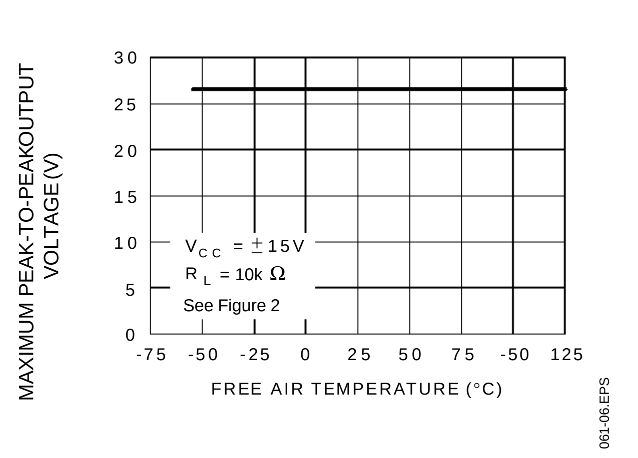
061-05.TBL

* The input bias currents of a FET-input operational amplifier are normal junction reverse currents, which are temperature sensitive. Pulse techniques must be used that will maintain the junction temperature as close to the ambient temperature as possible.

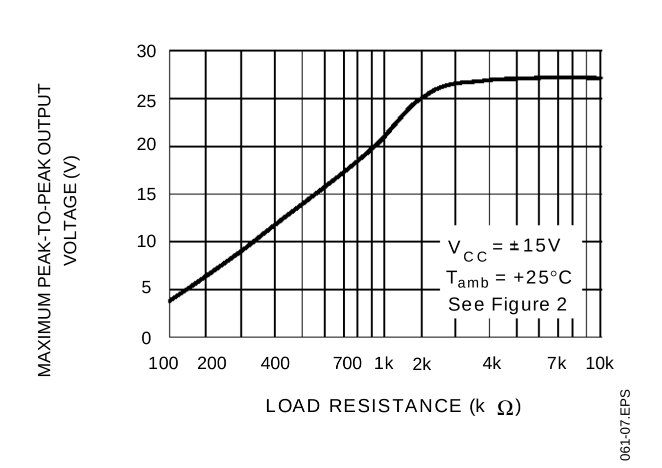
MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS SUPPLY VOLTAGE

MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE (V)
30
25
20
15
10
5
0
R_L = 10 kΩ
T_{amb} = +25°C
See figure 2
2 4 6 8 10 12 14 16
SUPPLY VOLTAGE (V)
061-05.EPS

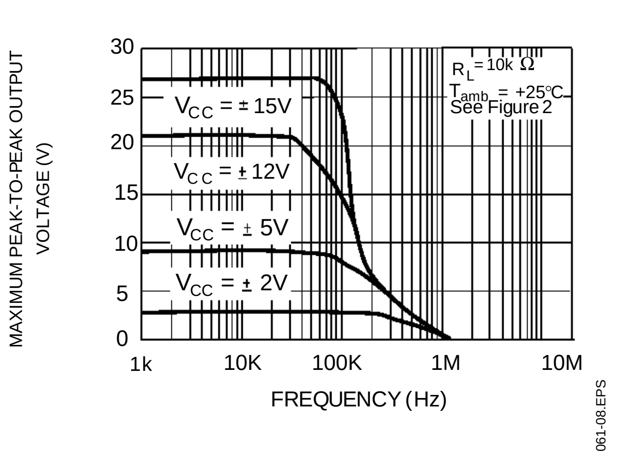
MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS FREE AIR TEMP.



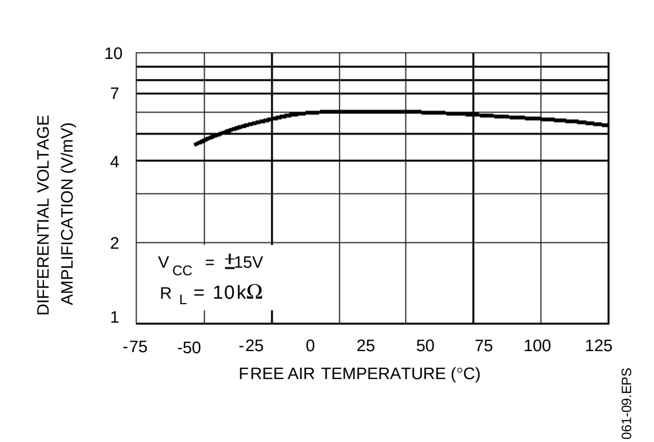
MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS LOAD RESISTANCE



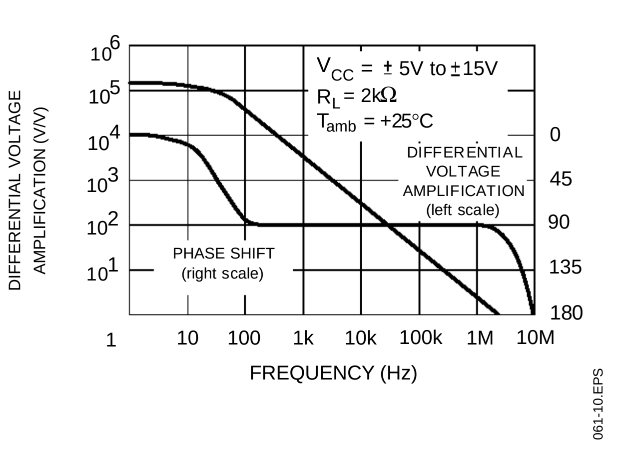
MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS FREQUENCY



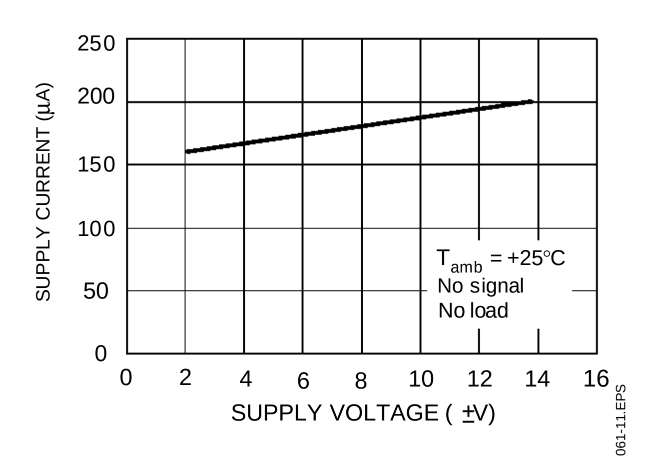
DIFFERENTIAL VOLTAGE AMPLIFICATION VERSUS FREE AIR TEMPERATURE



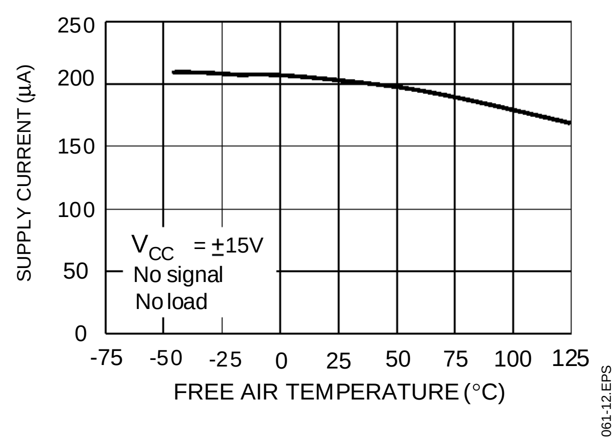
LARGE SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION AND PHASE SHIFT VERSUS FREQUENCY



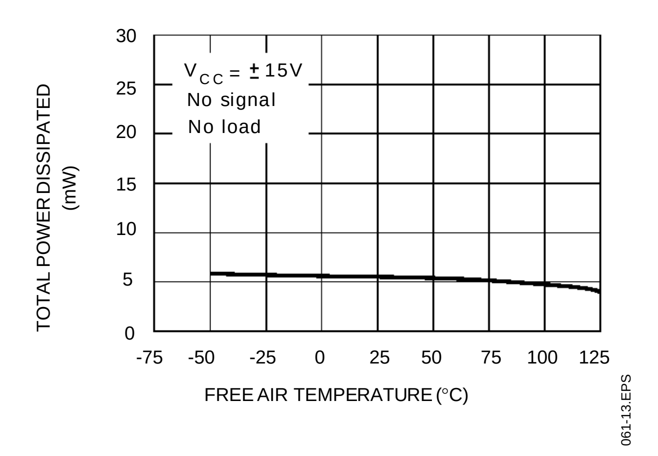
SUPPLY CURRENT PER AMPLIFIER VERSUS SUPPLY VOLTAGE



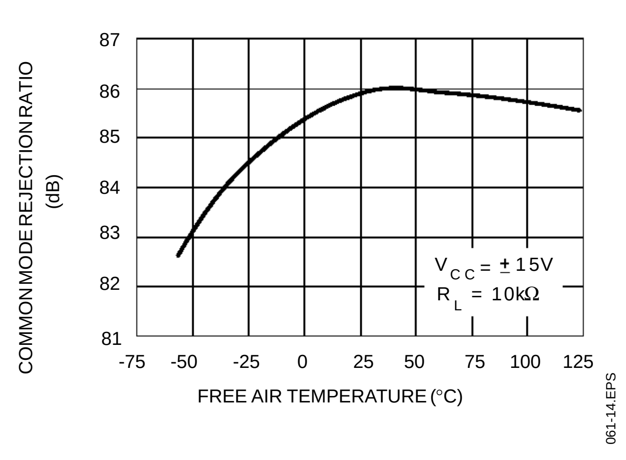
SUPPLY CURRENT PER AMPLIFIER VERSUS FREE AIR TEMPERATURE



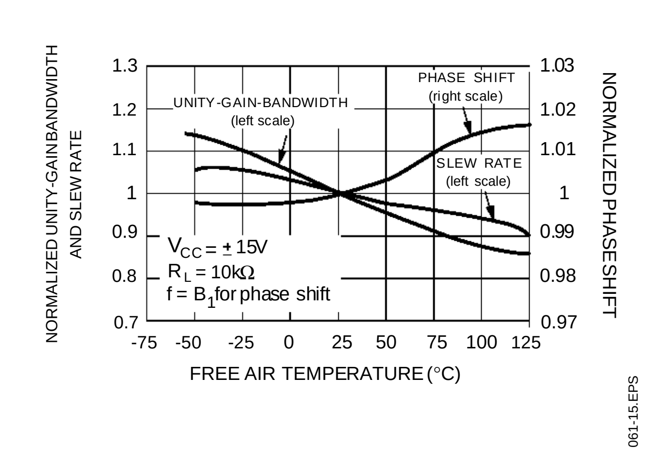
TOTAL POWER DISSIPATED VERSUS FREE AIR TEMPERATURE



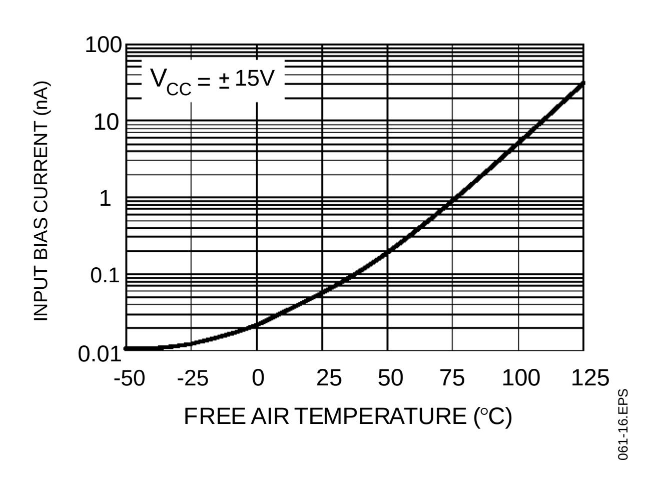
COMMON MODE REJECTION RATIO VERSUS FREE AIR TEMPERATURE



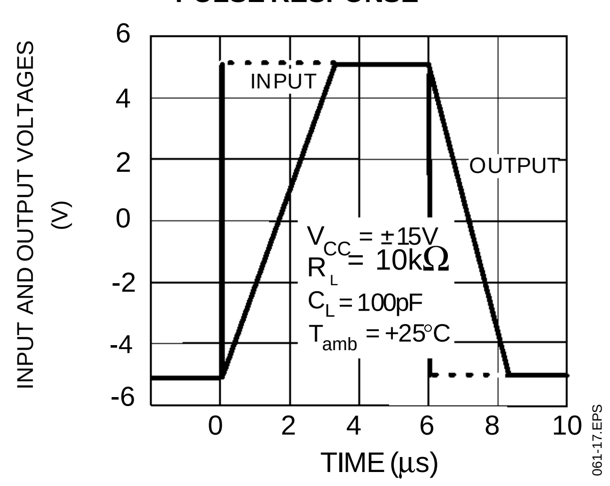
NORMALIZED UNITY GAIN BANDWIDTH SLEW RATE, AND PHASE SHIFT VERSUS TEMPERATURE



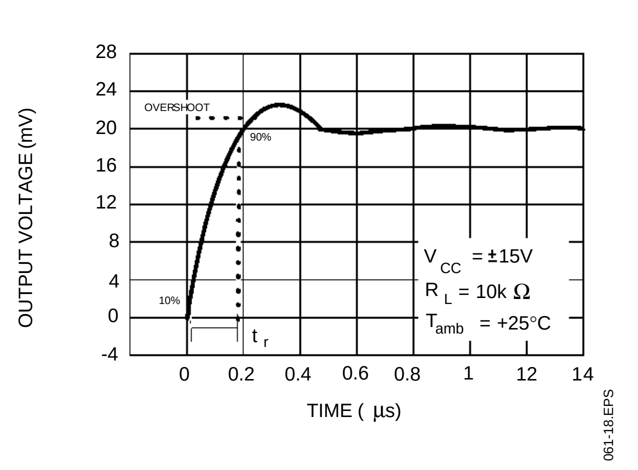
INPUT BIAS CURRENT VERSUS FREE AIR TEMPERATURE



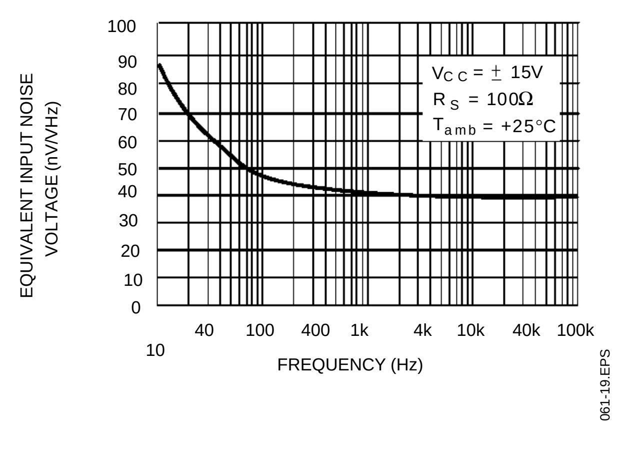
VOLTAGE FOLLOWER LARGE SIGNAL PULSE RESPONSE



OUTPUT VOLTAGE VERSUS ELAPSED TIME



EQUIVALENT INPUT NOISE VOLTAGE VERSUS FREQUENCY



PARAMETER MEASUREMENT INFORMATION

Figure 1 : Voltage follower

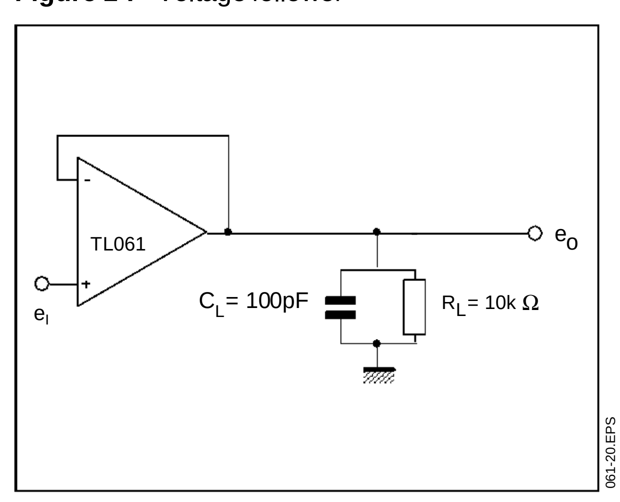
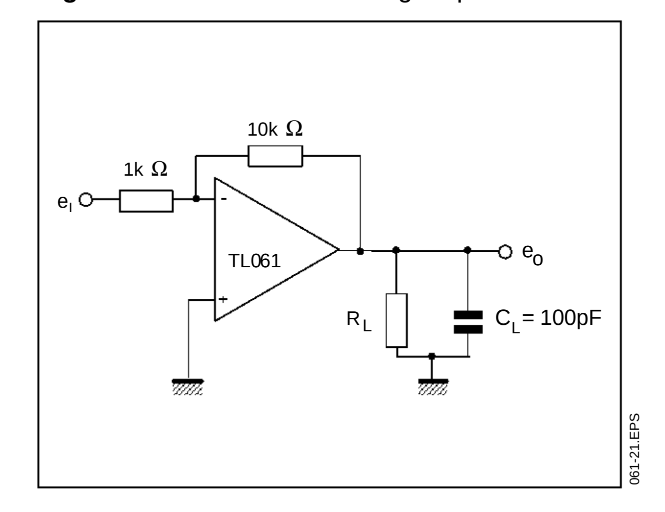
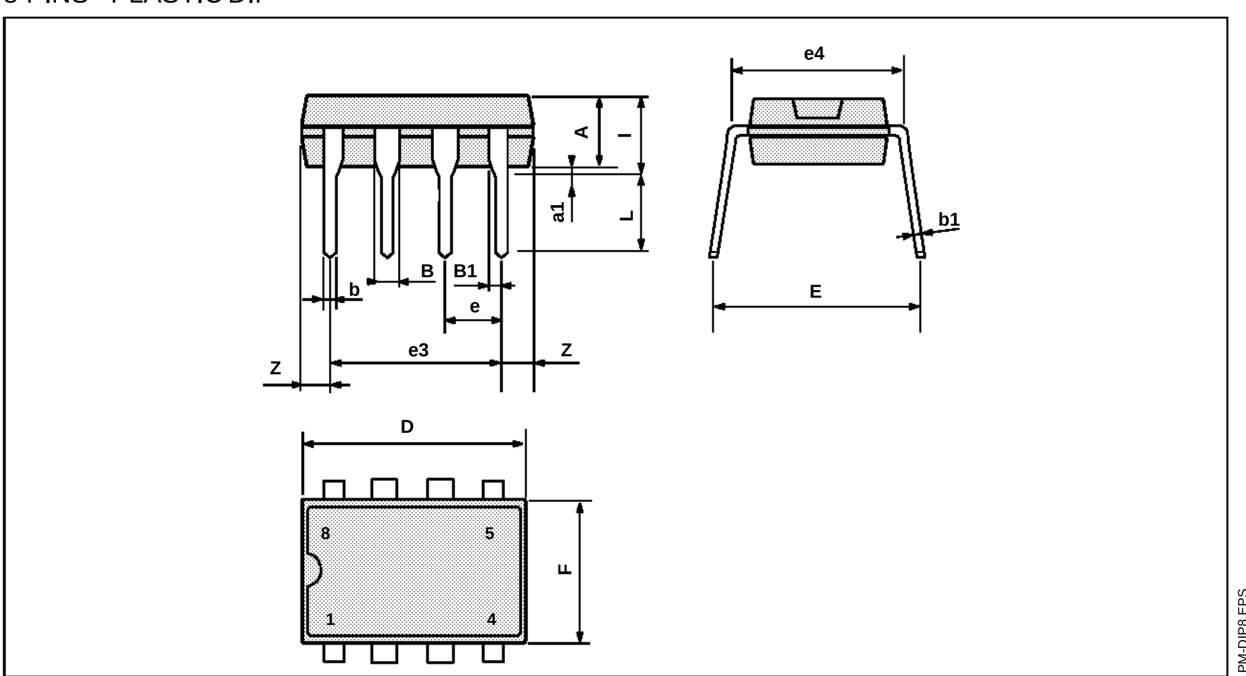


Figure 2 : Gain-of-10 inverting amplifier



PACKAGE MECHANICAL DATA

8 PINS - PLASTIC DIP

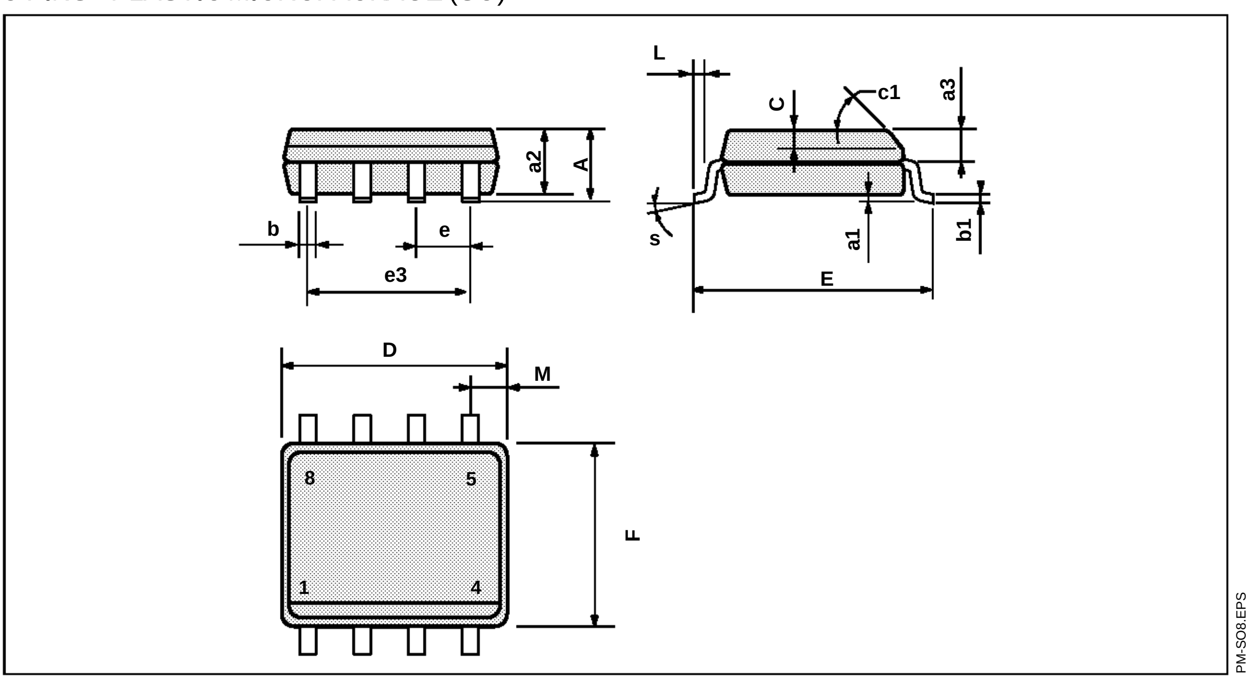


Dimensions	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A		3.32			0.131	
a1	0.51			0.020		
B	1.15		1.65	0.045		0.065
b	0.356		0.55	0.014		0.022
b1	0.204		0.304	0.008		0.012
D			10.92			0.430
E	7.95		9.75	0.313		0.384
e		2.54			0.100	
e3		7.62			0.300	
e4		7.62			0.300	
F			6.6			0260
i			5.08			0.200
L	3.18		3.81	0.125		0.150
Z			1.52			0.060

DIP8.TBL

PACKAGE MECHANICAL DATA

8 PINS - PLASTIC MICROPACKAGE (SO)



Dimensions	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.75			0.069
a1	0.1		0.25	0.004		0.010
a2			1.65			0.065
a3	0.65		0.85	0.026		0.033
b	0.35		0.48	0.014		0.019
b1	0.19		0.25	0.007		0.010
C	0.25		0.5	0.010		0.020
c1	45^o (typ.)					
D	4.8		5.0	0.189		0.197
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		3.81			0.150	
F	3.8		4.0	0.150		0.157
L	0.4		1.27	0.016		0.050
M			0.6			0.024
S	8^o (max.)					

SO8.TBL

ORDER CODE :

